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Vortex shedding experiments with Ekman friction[1] PAUL W. FONTANA, ELIZABETH BRASSEALE, JOHN P. GOERTZ, DAVID RASCHKO, JEMIN SHIM, Seattle University — We present an experimental investigation of the Strouhal instability in flowing soap films. In vortex shedding by a cylinder, Roshko's formula for the one-to-one relationship between the Strouhal number $St = fD/U_\infty$ and the Reynolds number $Re = U_\infty D/\nu$ is well-established empirically and in numerical simulations. (Here f is the vortex shedding frequency, D is the cylinder diameter, U_∞ is the upstreem flow speed, and ν is the kinematic viscosity.) However, the effect of homogeneous linear drag (Ekman friction) on the relationship has not previously been investigated. It has generally been assumed to be unimportant, but it is plausibly hypothesized to decrease the shedding frequency. If so, then ignoring drag may lead to inaccurate estimates of Re based on St in situations where Ekman friction is significant. We address the question with quasi-two-dimensional vortex shedding experiments in soap films in which we are able to resolve viscosity and surface friction. The results shed light on the instability mechanism of vortex shedding in particular, and they also demonstrate how precise measurement of both viscosity and surface friction is necessary to make soap film experiments useful for quantitative investigations of stability more generally.

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Paul W. Fontana
Seattle University

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